## REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendment and the following remarks.

Claims 1-6 and 11-17 remain pending and new claim 18 has been added herein.

At the outset, the Applicant wishes to thank the Examiners for the courtesy shown to his representative during a personal interview on May 28, 2002. The following discussion includes a summary of the points discussed during the interview.

New claim 18 depends from claim 1 and recites that:

> *the single crystalline film and a surface layer of the single crystalline substrate, upon which the single crystalline film is formed, have different molecular structures;*
>
> *the molecular structure of the single crystalline film is not an alloy of the molecular structure of the surface layer of the single crystalline substrate; and*
>
> *the molecular structure of the surface layer of the single crystalline substrate is not an alloy of the molecular structure of the single crystalline film.*

This claim recites features that are similar to those recited in claim 17, but claim 18 recites them with greater specificity. Exemplary, but non-limiting, support for the features recited in claim 18 may be found in Example 8, provided on pages 15 and 16 of the specification.

Claim 18 is not believed to raise new issues or require an additional search because its content is within the realm of the language (i.e., the broadest interpretation of the claims) that the Examiner would have considered in the previous examination of claim 17. Moreover, the second full paragraph on page 5 of the Office Action makes clear that the Examiner considered the situation where the single crystalline film was an alloy of the single crystalline substrate. Therefore, the entry of new claim 18 is believed to be appropriate and is respectfully solicited.

Claims 1-6 and 11-17 stand rejected, under 35 USC §103(a), as being unpatentable over Davis et al. (US 6,051,849) in view of Tokunaga et al. (US 5,425,808) and Nakamura et al. (JP 01-234389).

The Office Action asserts that Davis et al. teach each of the features of the rejected claims except for forming an amorphous film and the particular incidence angle of the atomic beams (i.e., not more than 40 degrees with respect to the substrate surface). Accordingly, the Office Action introduces Tokunaga et al. to provide a teaching of forming an amorphous film of $SiO_2$ or $Si_3N_4$. In addition, the Nakamura et al. reference is relied upon for teaching the optimization of an angle of incidence of the atomic beam.

It is well settled that, to establish a *prima facie* case of obviousness, the combined prior art references must teach or

suggest all claim limitations and additionally, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.

Through its dependency from claim 1, present claim 17 recites a single crystalline substrate. Atomic, molecular, or chemical beams are "introduced onto the surface of the [single crystalline] substrate" (emphasis added) to grow a single crystalline film on the exposed surface of the substrate. Present claim 17 further limits claim 1 by reciting that the single crystalline substrate and the atomic, molecular, or chemical beams are of different materials.

Although a semiconductor produced by the method of claim 17 may have multiple substrate layers, the particular substrate layer upon which the single crystalline layer is grown by the atomic, molecular, or chemical beams is identified by the nomenclature of the "single crystalline substrate." In the description of one non-limiting embodiment of the invention, the specification states that the atomic or molecular beams are "introduced onto a surface of the single crystalline substrate" (page 6, lines 15 and 16); "Thereby, a uniform single crystalline film can be epitaxially grown on the exposed part of the substrate" (page 6, lines 19-21).

In a non-limiting embodiment of the invention de cribed on page 15 of the specification, a single crystalline film of YBCO is formed on a single crystalline substrate of $SrTiO_3$. In this embodiment, the single crystalline film is formed of a first material, YBCO, and the single crystalline substrate is formed of a second material, $SrTiO_3$.

New claim 18 more definitely recites the features of: (1) forming the single crystalline film on the surface of the single crystalline substrate; and (2) forming the single crystalline substrate and the single crystalline film using different materials. This new claim states that the single crystalline film and a surface layer of the single crystalline substrate, upon which the single crystalline film is formed, have different molecular structures.

In rejecting claim 17, the Office Action asserts that Davis discloses a substrate having multiple layers and that one of these layers is a different material than the single crystalline layer formed by ELO. However, as acknowledged in the Office Action, the single crystalline layer is either GaN or an alloy of GaN and the top layer of the substrate, upon which the single crystalline layer of GaN is grown, is also formed of GaN.

The Office Action further alleges that Davis discloses that an AlGaN layer can be grown on a substrate formed of a different

material (page 5, section 4). It is respectfully submitted that this assertion is not supported by the cited portion of the reference (Davis at col. 1, lines 40-45). The cited text identifies the title of a document and reads as follows:

> *Selective Growth of GaN and $Al_{0.2}Ga_{0.8}N$ on GaN/AlN/6H-SiC(0001) Multilayer Substrates Via Organometallic Vapor Phase Epitaxy*

The title neither expressly states nor implies that AlGaN can be grown on a substrate of a different material. Instead, the title expressly states that *GaN and $Al_{0.2}Ga_{0.8}N$* may be selectively grown on a multilayer substrate. The more reasonable inference that may be read into the phrase "GaN/AlN/6H-SiC (001) Multilayer Substrates" is that the multilayer substrate is formed from individual layers of GaN, AlN, and SiC or a combination of these molecular structures, such as AlGaN. Since the title expressly states that the substrate is a multilayer substrate, it is likely that the referenced growth of GaN is performed on the particular substrate layer made of GaN. Similarly, it is likely that the referenced growth of AlGaN is performed on a particular substrate layer made of AlGaN. This interpretation is strongly supported by the statement made in the Tokunaga reference (US 5,425,808).

Tokunaga states that "selective deposition methods are known in which a monocrystal substrate is covered partially with an amorphous thin film, and the same material as the substrate is

epitaxially grown only at the exposed portion of the monocrystal substrate" (col. 2, lines 13-17). "[T]hese selective deposition methods rely on growing selectively the monocrystal semiconductor of the same kind from the exposed surface of the monocrystal substrate" (emphasis added) (col. 2, lines 28-31). Therefore, Tokunaga teaches away from the claimed combination recited in claims 17 and 18. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743 218 USPQ 769, 779 (Fed. Cir. 1983); see MPEP §2145 XD2.

Tokunaga is applied in the Office Action to disclose the selective epitaxial growth of GaAs on an amorphous $SiO_2$ or $Si_3N_4$ film using molecular beam epitaxy or chemical vapor deposition (page 3, 2nd full paragraph). The Office Action further states that col. 2, lines 14-29, of Tokunaga provide this teaching. However, as quoted above, this portion of Tokunaga expressly teaches away from selectively growing a single crystalline layer of a first material on a single crystalline substrate of a second material, through an amorphous mask. Therefore, Tokunaga teaches away from being combined with the teachings of Davis.

Claim 17 stands rejected based on the combined teachings of Davis, Tokunaga, and Nakamura. Because Tokunaga teaches away from combining its teachings with those attributed by the Office Action

to Davis, it may not be properly combined with the inferred teachings attributed to Davis. Therefore, allowance of claim 17 is appropriate.

New claim 18 is believed to be allowable for a similar reason. Additionally, even assuming, *arguendo*, that the quoted portion of Davis in col. 1, lines 40-45, discloses the alleged epitaxial growth of AlGaN on a GaN substrate, AlGaN is an alloy of GaN (see Davis col. 1, lines 21-25). Claim 18 recites that the molecular structure of the single crystalline film grown on the surface layer of the single crystalline substrate is not an alloy of the molecular structure of the surface layer. Therefore, claim 18 is patentable for this additional reason.

During the personal interview, both the Examiners indicated that the description provided by Davis in column 1, lines 26-36, further supports the position that Davis teaches growing a single crystalline film of a first material on a single crystalline substrate of a second material, through an exposed portion of an amorphous film formed on the substrate. The referenced passage states:

> *"it is known to reduce defect density by growing gallium nitride layers on aluminum nitride buffer layers which are themselves formed on silicon carbide substrates."*

However, the referenced passage in Davis fails to disclose the claimed features of forming an amorphous film on a single crystalline substrate, forming an opening in the amorphous film and thereby exposing a part of the surface of the substrate, and epitaxially growing a single crystalline film on the exposed surface of the substrate by introducing atomic, molecular, or chemical beams onto the surface of the substrate. More specifically, for example, the referenced passage does not indicate whether the gallium nitride and aluminum nitride layers are polycrystalline or single crystalline layers. Additionally, with exemplary specificity, the Office Action acknowledges that Davis fails to disclose forming an amorphous film on the single crystalline substrate and fails to disclose forming a single crystalline film by introducing atomic, molecular, or chemical beams onto the surface of the single crystalline substrate (see page 3 of Office Action).

With regard to claim 1, Applicant submits that Tokunaga only discloses the ELO technique, which is only usable in the CVD method. The ELO technique requires the film and the substrate to be made of the same material.

In addition, Applicant submits that the CVD method and the MBE method are quite different in principle. In the CVD method, raw material gases are supplied onto a given substrate (or a given

underlayer), non-directionally, and thermally reacted on the substrate. On the other hand, in the MBE method, an atomic beam or a molecular beam (not raw material gas) is supplied onto a given substrate, directionally, and deposited directly on the substrate without the thermal reaction.

Applicant further submits that the sputtering method and the CVD method are also quite different in principle, which is commonly known to one of ordinary skill in the art. That is, the CVD method and the sputtering method are not equivalent substitutes. Even though a given film can be formed in good condition by means of the CVD method, it cannot always be formed in good condition by means of the sputtering method. Also, the film cannot always be formed by means of the MBE method. Therefore, the CVD method and the MBE method are not equivalent substitutes.

Lastly, Applicant submits that although Nakamura may teach the incidence angle within 0-90 degrees, an incidence angle within the above range is necessarily required so as to introduce a given atomic beam or a molecular beam on a main surface of a given substrate. If the incidence angle is set outside the above range, the atomic beam or the molecular beam is introduced on a backside surface of the substrate, not on the main surface. That is, Nakamura only discloses a normal incidence angle usable in the MBE method and does not teach varying the incidence angle so as to

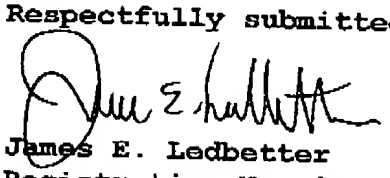
epitaxially grow a single crystalline film on a given substrate made of a different material from the one of the film.

Therefore, Applicant respectfully submits that claim 1 and all claims dependent therefrom are allowable.

In view of the above, a notice of allowance is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,



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